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Douglas A. Hawks

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EXAMINER

TRINH, MICHAEL MANH

ART UNIT

PAPER NUMBER

2822

MAIL DATE

DELIVERY MODE

10/05/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/649,577

Applicant(s)

HAWKS ET AL.

Examiner

Michael Trinh

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 11 July 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,2,5-8,16,17 and 20-28 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,2,5-8,16,17 and 20-28 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☐ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- ☐ Notice of Informal Patent Application
- ☐ Other: _____

DETAILED ACTION

*** This office action is in response to Applicant's Amendment filed on July 11, 2007. Claims 1-2,5-8,16,17,20-28 are pending.

*** The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim Rejections - 35 USC § 103

1. Claims 1-2,5-6,16,20-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fjelstad (6,001,671) taken with Landi (4,944,087) and Juskey et al (5,218,759).

Re claim 1, Fjelstad '671 teaches (at Figs 2A-2E,2F, col 5, lines 26-65; Figs 1A-1G-1, 1D-3; col 1-5; col 3, line 53 through col 5) a method for forming a package for an electronic device, the method comprising the steps of attaching a removable material of polymer sheet (100' in Figs 2A, col 5, lines 26-65; 100 in Fig 1) to a surface of a conductive material (101' in Fig 2A; cols 5, lines 26-65; 101 in Fig 1), wherein the removable material of polymer material, polyimide, polyetherimide, fluropolymer (col 3, lines 61-62) are soluble, and can be dissolved in a specific etching solution (col 5, lines 60-65); forming isolated conductive features (110' in Figs 2B,2F; 110 in Figs 1B,1D-3) within said conductive material; forming a die attach pad 115' within the conductive material (Fig 2B, col 5, lines 26-65); coupling the electronic device 120' to the die attach pad 115' (Figs 2B-2E); attaching an encapsulant (140' in Fig 2D; 140 in Fig 1E) to the isolated conductive features (110' in Figs 2B,2F; 110 in Figs 1B,1D-3), the die attach pad 115', the electronic device 120', and the removable material 100' of polymer material (Figs 2D-2E); and removing the removable material from the conductive features 110',115',110 and the encapsulant (Fig 2F, col 5, lines 60-65; Fig 2E, col 5, lines 45-65; Figs 1E-1F; col 4, line 66 through col 5), wherein the entire polymer sheet 100' of the removable material may simply be removed by chemically dissolving the sheet leaving the pads 110' and the central conductive region 115' exposed so as to provide a package of an electronic device 120' as similarly shown in Figures 4A, 4B, 3, and 1E-1G-1. Re claim 2, wherein the step of forming isolated conductive pad features includes patterning and selectively etching of a metal deposit layer using photolithographic technique (col 5, lines 26-40; Figs 2A-2B), which photolithographic techniques is obviously and inherently performed by patterning a surface of the conductive material with a material resistant to an etchant and etching the conductive material with the

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etchant, wherein a die attach pad 115' is formed within said conductive material (Figs 2A-2C), wherein the device 120' is coupled to said die attach pad 115' (Figs 2C). Re claim 5, wherein an input/output portion of the device 120' is electrically coupled to said isolated conductive feature 110' (Figs 2C,2F,1D-3). Re claim 6, wherein the method further comprises the step of singulating individual packaged devices (Figs 1F,1G-2; col 5, lines 10-65). Re claim 16, wherein the removable material 100',100 is used and acted as a molding stencil during molding of encapsulant 140',140 (Fig 1E;2D; col 4, lines 56-65; col 5, lines 26-65). Re claim 20, wherein the conductive material 101',101 of metal deposit comprises a metal frame sheet (Figs 2A-2F,1D-1F). Re claim 21, wherein the conductive material of metal deposit film comprises and acts as a metal leadframe (Figs 2A-2F,1A-1F, Figs 1D-3). Re claim 22, wherein die attach pad 115' is not offset from the isolated conductive features 110' (Figs 2B-2C;2F;1D-3). Re claim 23, wherein a single row of connectors 110',110 is formed around perimeter of the leadframe (Figs 2F,2B,1D-2). Re claim 24, wherein the metal frame comprise a metal sheet by metal deposition (Fig 2A; col 5, lines 26-45). Re claim 25, wherein multiple rows of connectors 110,110' are formed around a peripheral of the metal sheet (Figs 1D-3, 2B,2F; col 4, lines 1-31). Re claim 26, wherein the removable material 100,100' covers substantially the entire bottom surface of the metal lead frame (Figs 2A-2F,1C-1E). Re claim 27, wherein the electronic device 120' is coupled to the die attach pad 115' via a conductive epoxy (Fig2C,1C; col 5, lines 35-45; col 4, lines 32-45).

Fjelstad already discloses (at col 5, lines 60-65,27-65; Figs 2A-2E) removing the removable sacrificial material 100' of polymer sheet attached to a layer of conductive copper material 101', wherein the entire polymer removable sacrificial sheet 100' can be removed by chemically dissolving the removable material of polymer sheet which is soluble.

Fjelstad thus lacks mentioning the removable material comprising an soluble adhesive.

However, Landi teaches (at Figs 5, step 1; col 5, lines 1-35; col 6 lines 14-50; col 2, lines 6-65; Figs 1-4; col 4, line 7-54) employing a removable material comprising a soluble adhesive in order to easily laminate and attach the removable material comprising the soluble adhesive to a surface of a conductive material, wherein the removable material 16 comprises a polyimide material and a soluble adhesive (col 5, lines 12-35; col 6, lines 14-50; col 7, lines 38-51),

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wherein the removable material comprising the soluble adhesive is removed by dissolving the adhesive with a solvent after molding to encapsulate the circuit pattern with an encapsulant.

Juskey et al also teach (at Figs 1-3; col 2, lines 25 through col 3, line 59) employing a removable material 18 comprising a soluble adhesive 19 as a temporary support removable material for bonding and attaching to an electronic device 10; forming an encapsulant 30 thereon (Figs 2-3, col 3, lines 1-20), and thereafter removing the removable material from the feature either by peeling(col 3, lines 40) or by dissolving or degrading the adhesive bonding with chemical materials that should not cause degradation of the molding compound (col 3, lines 40-46).

Therefore, the subject matter as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made to attach the removable material layer 100' to the film of conductive material 101' of Fjelstad by employing a removable material comprising a soluble adhesive for attaching to the conductive material, as taught by Landi and Juskey. This is because of the desirability to surely adhere the removable material to the conductive material, and to improve the adhesion in order to laminate and attach the removable material comprising the soluble adhesive to a surface of a conductive material. This is also because of art recognized alternative and equivalent for substitution with the desirability to simplify and easily facilitate the removal of the removable material comprising the soluble adhesive from the encapsulated device by simply dissolving the adhesive in a solvent.

2. Claims 7-8 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fjelstad (6,001,671), Landi (4,944,087), Juskey et al (5,218,759), as applied to claims 1-2, 5-6,16,20-27 above, and further of Wyland (6,111,199) and Weng et al (5,972,234).

Fjelstad '671 and Landi teaches a method for forming a package for an electrical device as described to claims 1-2,5-6,16,20-27 above, and repeated herein. Re further claim 17, Fjelstad '671 also teaches (at col 5, lines 60-65, 26-65; col 7, lines 12-16;) the removable material comprising a polyimide polymer that can be soluble and dissolved in a specific etching solution (col 5, lines 60-65). Landi also teaches (at col 5, lines 15-35, col 6, lines 21-50) the removable material comprising a polyimide and a soluble adhesive.

The references of Fjelstad and Landi already teaches using and removing the removable material comprising the soluble adhesive by simply dissolving the adhesive in a solvent, but

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lacks mentioning about a water-soluble adhesive (as in claims 7-8,17); deionized water for removing (as in claim 8).

However, *Wyland et al* teach (at col 8, lines 1-10; col 7, lines 54-67) forming a removable adhesive resin film on a substrate, wherein polyimide, alkali-soluble resin, or water-soluble resin are alternatively used for forming the adhesive resin film. *Weng* teaches (col 5, lines 34-37,27-51; and col 4, line 25 through col 5, line 51) the removable material for electronic device comprises a polymeric-base material and a water soluble adhesive, wherein removing the removable adhesive material is performed with deionized water (as a pure water).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the removable material Fjelstad by employing a water-soluble adhesive of resin and polyimide, as taught by *Wyland* and *Weng*. This is because the substitute art recognized equivalent removable materials, as alternative materials, is within the level of one of ordinary skill in the art, wherein water-soluble resin material or polyimide are highly adhesive to the terminals of the lead frames, wherein, by using water soluble resin/adhesive, removing the removable materials can be easily and conveniently performed with water, as further taught by *Weng*, and less expensive, wherein with the use of deionized water, as a high purity water, ion contamination of the device is prevented and thereby improving reliability and quality.

3. Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fjelstad (6,001,671), Landi (4,944,087) and Juskey et al (5,218,759), as applied to claims 1-2,5-6,16, 20-26,27 above, further taken with Roche et al (4,530,152).

The references including Fjelstad '671, Landi, and Juskey teach a method for forming a package for an electrical device as applied to claims 1-2,5-6,16,20-26,27 above, and fully incorporated herein. Fjelstad also teaches attaching the removable material is performed before one or more isolated conductive features 110' have been formed within the conductive material (Fig 2B), wherein attaching an encapsulant (140' in Fig 2D; 140 in Fig 1E) is performed before a singulation process to separate the package; and removing the removable material from the conductive features 110',115',110 and the encapsulant (Figs 1E-1F; col 4, line 66 through col 5; Fig 2F, col 5, lines 60-65; Fig 2E, col 5, lines 45-65). Furthermore, Fjelstad also teaches removing the removable material 100' of polymer material from the conductive features 110',

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the die attach pad 115', the electronic device 120', and the encapsulant 140' (Fig 2F,2E, col 5, lines 60-65; 45-65). Landi teaches (at col 5, lines 28-35; col 7, lines 39-47; col 6 lines 14-50; Figs 5, step 1; col 5, lines 1-35; Figs 1-4; col 4, line 7-54) laminating and attaching a removable material comprising a soluble adhesive and a polyimide material to a surface of a conductive material, and thereafter removing the removable material comprising the soluble adhesive by dissolving the soluble adhesive with a solvent after molding to encapsulate the circuit pattern with an encapsulant. Juskey et al also teach (at Figs 1-3; col 2, lines 25 through col 3, line 59) employing a removable material 18 comprising a soluble adhesive 19 as a temporary support removable material for bonding and attaching to an electronic device 10; forming an encapsulant 30 thereon (Figs 2-3, col 3, lines 1-20), and thereafter removing the removable material from the feature either by peeling (col 3, lines 40) or by dissolving or degrading the adhesive bonding with chemical materials that should not cause degradation of the molding compound (col 3, lines 40-46).

Re claim 28, the references including Fjelstad thus lack mentioning to remove the removable material after the singulation process.

However, Roche teaches removing the removable sacrificial material from the conductive features 2 and the encapsulant 5 (col 3, line 62 through col 4, line 25), wherein the removing the material step can be performed before or after the singulation process for separating the package (col 4, lines 20-25).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to remove the removable material of Fjelstad either after a singulation process to separate the package or prior to a singulation process as alternatively taught by Roche. This is because removing the removable material either after or prior to the singulation process are alternative and art recognized equivalent processes for substitution in fabrication of the electronic device, and because of the desirability to expose a portion of the metal lead frame and conductive features for subsequent electrical connection, wherein by removing the removable material after singulation process, the removable material would still cover and thereby consequently protect the isolated conductive features and metal lead frame from being contaminated during singulation process.

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Response to Arguments

****** Applicant's amendment and remarks filed July 11, 2007 have been fully considered but they are moot in view of the new ground(s) of rejection.

Fjelstad clearly teaches (at col 5, lines 60-65) that "...the entire polymer sheet 100' may simply be removed by chemically dissolving the sheet...". Moreover, the polymer sheet can be dissolved and soluble in a specific chemical etching solution. By using chemical etching to remove the removable material of Fjelstad, the removable material is dissolved and soluble in that chemical etching solution. However, Landi prima facie obviously teaches (at col 5, lines 28-35; col 7, lines 39-47; col 6 lines 14-50; Figs 5, step 1; col 5, lines 1-35; Figs 1-4; col 4, line 7-54) laminating and attaching a removable material comprising a soluble adhesive and a polyimide material to a surface of a conductive material, and thereafter removing the removable material comprising the soluble adhesive by dissolving the soluble adhesive with a solvent after molding to encapsulate the circuit pattern with an encapsulant. Additionally, Juskey et al prima facie obviously teach (at Figs 1-3; col 2, lines 25 through col 3, line 59) employing a removable material 18 comprising a soluble adhesive 19 as a temporary support removable material for bonding and attaching to an electronic device 10; forming an encapsulant 30 thereon (Figs 2-3, col 3, lines 1-20), and thereafter removing the removable material from the feature either by peeling (col 3, lines 40) or by dissolving or degrading the adhesive bonding with chemical materials that should not cause degradation of the molding compound (col 3, lines 40-46).

The rejections are outstanding and maintained.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael M. Trinh whose telephone number is (571) 272-1847. The examiner can normally be reached on M-F: 9:00 Am to 5:30 Pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Zandra Smith can be reached on (571) 272-2429. The central fax phone number is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Oacs-15-18



Michael Trinh
Primary Examiner